THE USE OF COMPUTERS IN PLANNING

AN OVERVIEW OF THE ONTARIO SITUATION

Ontario
Ministry of Municipal Affairs and Housing
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1. Introduction

The use of computers in planning started during the early sixties. Land use transportation studies were probably the very first applications.On the assumption that the land use and the transportation network in an urban area are inter-related, studies of traffic flows and the transportation network necessary to accommodate such flows were undertaken in many places in England and the U.S. In Canada, a major transportation study was undertaken during the mid sixties. The Metropolitan and Region Transportation Study (MTARTS) was initiated by the Province to examine the transportation requirements of the Toronto Centred Region (TCR) to the year 2000. Transportation studies required input of socio-economic and land use data wihich planners were asked to provide. It was soon realised that although these studies were statistically accurate, the input data from planners was of poor quality. Planners not only lacked a sound data base, but also suitable projection techniques to confidently project future values of the input data such as population and employment and a consistent historic record to provide a basis for model calibration[1]. As a result of these frustrations an interest grew in strengthening these areas of weakness.

The applications of computers gradually expanded in planning departments because most planning tasks such as employment and population projections required the repetitive manipulation of large amounts of data and complex calculations — tasks best suited to and greatly aided by the use of computers. However, computers were generally used for one-shot applications such as regional or sub-regional study or an impact analysis of a shopping centre.

At present, computers are being used in a multitude of tasks from filing of data to computer graphics, geoprocessing[2], monitoring and in some cases, as an instrument of decision-making itself. The use of computers in ongoing tasks such as plan development, plan amendment and development control is also steadily increasing. The pay offs are not the same in all these applications as they depend not only on how suitable a given task is to computer use but also on a vast number of other factors such as the size and complexity of planning tasks; quality, variety and practicality of hardware[3] and software[4]; staff experience and knowledge in using computers; and above all, management of the entire operation.

Most local governments have learned that computer benefits accrue only if all the pieces of a computing package fit together properly. The package includes computer personnel and management, computer users, computer hardware, operating software and application programs. If a key piece of this package is deficient or missing, the whole organization suffers and the full benefits of computing are difficult to obtain.

By using computers, planning actions and decisions can be based on better quality data. For many municipalities this has been rather difficult to perceive and thus planning has suffered as a result. More recently, however, partly due to the decrease in hardware costs, the rapid and widespread use of computers in many other areas, and, to some extent, the personal enthusiasm of many young planners joining municipal organizations with practical experience in the use of computers, the benefits of using computers in planning are being recognized.

It is expected that, in the near future, medium-size municipalities (10,000 — 100,000 population) will be setting-up, or updating, their computer capabilities to adequately meet their planning and other needs. In order to get the best value out of their investment, it is important that such municipalities be able to identify their design objectives clearly and know the available options, trends in computer technology and the experience of others who are using computers. This report provides an overview of the use of computers in planning in Ontario.

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1 The process of making adjustments to the mathematical relationships in a model in order to obtain the desired results.

2 Processing of data which can be identified by its geographic location.

3 The physical computer equipment which includes processor, memory, peripherals, terminals, etc.

4 Generic term for computer programs. It controls hardware operations. Software also includes data used with programs.

2. A General Review of the Use of Computers in Planning

The purpose of the review of the literature on the application of computers in planning was to obtain a general overview of the present "state of the art," as well as an insight into future planning applications.

The review is presented from two different but very important angles. Section 2.1 briefly discusses specific tasks or exercises where computer aid can be utilized and section 2.2 discusses the various facilities, especially software packages[1], available to planners in order to carry out the specific tasks discussed in section 2.1.

2.1 Computer Assistance in Planning

The specific planning tasks where computer aid is being utilized can be grouped broadly into the following categories:

- acquisition, storage and retrieval of data
- manipulation and analysis of data
- modelling[2]
- computer mapping and graphics
- word processing[3]

2.1.1 Acquisition, Storage and Retrieval of Data

Where automation is not used, data acquisition is carried out by the assembly of hard copy material. Further integration or retrieval of data is then carried out manually by the physical examination of files. This can be very time consuming and sometimes may not produce the required information in time for subsequent analysis or decision making. Automation can provide record keeping in an orderly fashion and above all provide read*y* access and retrieval of data.

Planners require a large amount of data, and therefore the benefits in establishing a data bank are high, especially for medium to large sized municipalities.

Data can be classified according to its socio-economic or land use characteristics and it can come from both external (such as census and assessment records) or internal (such as surveys, planning applications or monitoring) sources. Since raw data comes in a variety of shapes and forms, it has to be refined before appropriate data bases can be established.

In the future, with the development of suitable software, retrieval of data from some of the most important sources such as Statistics Canada will become easier. For example, in the United Kingdom and the United States, software programs are available which can be used to access census summary tapes. In addition, many private firms have the capability of providing data on aggregated levels as needed.

Since most of the data planners use must be identified spatially by a code (such as an address), geocoding[4] often becomes a basic tool in the management of most of the data.

Geocoding

Virtually all data used by planners relates to land use in some form or other. In order to relate data to its geographical location planners create a system of zones. Data is assembled, retrieved and analyzed on the basis of these zones. The major problem in this traditional method is that it is a very rigid system for data assembly, retrieval and analysis. Since different data is available on a different zonal basis, such as school districts, traffic zones, census tracks, etc., it is very difficult to integrate this data without going back to original raw data files. The second problem is that once data is aggregated on a particular zonal basis, its further resolution becomes almost impossible. Any particular zonal basis cannot meet all different analysis requirements.

In order to overcome the above difficulties, it was decided to apply a more flexible geographic reference system. Early U.S. work in this area involved the assignment of one general geographic code (Geocode) to each data record. Rather than the name of a zone the geocode is a set of measurements (i.e. grid co-ordinates). Now any data zone can be defined in terms of the grid co-ordinates of its boundaries. Once a piece of data is digitized[5], it can then be aggregated as required by the planner.

One of the first practical applications of geocoding in the U.S. was the Street Address Conversion System (SACS). The features of SACS are:

- procedures to convert a street map to digital form;
- programs that relate any data address to a SACS digital map street segment and calculate an individual grid co-ordinate reading for the address;
- procedures to define any set of data retrieval zone in terms of grid co-ordinates along the zones' boundaries; and

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1 A program or group of programs to perform a specific application or task and available as a complete package.

2 Establishing mathematical relationships which tend to describe, as closely as possible, real world relationships between different variables.

3 Manipulation of words and text by a computerized system.

4 Method of assigning a set of geographic identifiers to each data record.

5 When data is represented by discrete numerical quantities, such as binary representation used in modern computing, it is said to be digitized.

- programs to test grid co-ordinate values for inclusion in any of the data retrieval zones.

In Canada, The Bureau of Census and Statistics Canada developed a geocoding system in the mid sixties to store and manage census data. The resulting system allows flexible retrieval of data by individual address on a regional basis.

Although geocoding provides a very flexible data retrieval system, it still can only work in a perfect manner when each data item is appropriately digitized. When it comes to combining one set of spatial data (e.g. census data) with other spatial information, problems arise. First, the accuracy and resolution of different data sets can vary considerably, causing frequent misinterpretation of mapping results. Since different data bases have different structures (or programs), conversions can result in loss of information. Presently, very few geocoding systems exist that attempt to combine different geographic data types.

The present state of the art is such that various types of geocoding systems are available which can be designed to suit an individual user environment. However, there is a growing need for a uniform and commonly accepted geocoding system to be established on a large geographic unit basis (e.g. province) to allow easy transfer and transformation of various types of available data from different sources at different spatial levels. In this respect the Government of Ontario adopted The Universal Transverse Mercator (UTM)[1] Grid System as the official standard geographical referencing grid for the Province. In addition it has embarked on a basic mapping program which will provide accurate topographic maps displaying the UTM grid.

Once the basic mapping program was in place the Interministerial Committee on Geographical Referencing (ICOGR) was formed to provide a forum for the discussion and exchange of information on geographical referencing activities in Ontario. The Committee is studying referencing needs and developing and promoting the use of standards towards the implementation of a comprehensive geographical referencing system for the Province. The Committee hopes that, in time, these standards will be incorporated into many of the information systems in the Province in order to expedite the transfer and correlation of geographically referenced data.

Computerized Statistical Information System (CSIS)

Whether a municipality has geocoded its area or not (and at the present time very few municipalities have done so), the first and most important step in the systematic use of computer technology in planning should be the establishment of a computerized statistical information system. Once established, its payoff in the form of easy access to information and as imput to other computer applications such as analysis, modelling, and geoprocessing (especially if data is digitized) is extremely valuable.

It is not possible to describe various elements, methods, or problems of CSIS here as this would require far too much detail. However, common characteristics and facilities of CSIS include:

- The integratation into a single record by means of a geocode, or an identifier such as an address, the information about a single entity (e.g. a building or lot) that exists in diverse government files.
- The placement into a single computer file selected data items about the same entity that exist in diverse operating files. The separate files and systems created from the integrated information is usually called a DATA BANK.
- the support of various computer software programs, such as a computer mapping and data retrieval package, that are used to manipulate a data bank and produce information in a variety of efficient and timely output forms.

Data Banks

Data banks are an important part of a municipality's CSIS system. A data bank is a computer file or system of selected data documents from diverse operating files. The documents selected are those most needed by planners. There can be many types of data banks of which the most common is a *real property data bank*.

In this data bank the basic unit is a lot or a parcel. The records contain selective data about the property (i.e. size, land use, zoning, tax status, etc.) as well as an identifier such as address, census tract, or a geocode. The quality of information and specific detail would depend upon many factors such as automation of original records, funds, and experience gained in setting up and operating a data bank.

An example of an operational real property data bank is the Land Registration and Information System (LRIS) developed in the late 60's by planning officials in Prince Edward Island, Nova Scotia and New Brunswick which is operated by

[1] It is a systematic, conformal, mathematically defined metric system of geographic referencing. For a full description of this system please refer to Ontario Ministry of Natural Resources' handbook entitled "The Ontario Geographical Referencing Grid (The Universal Transverse Mercator Grid System)." 1981.

a multi-provincial agency. This system incorporates both survey programs and land information systems.

Many local governments in North America are presently engaged in setting up or modernizing their land record data banks. Much literature is available on many aspects of such systems. It is not possible to outline the best system. A municipality's specific needs and resources are the main criteria for choosing and developing a particular system.

2.1.2 Manipulation and Analysis of Data

The previous section discussed certain aspects of acquiring, storing and retrieving data that is most needed by planners. However, an important role of a planner is not simply an ability to acquire, store and retrieve data but also to be able to do various types of analyses and modelling exercises in order to generate planning information needed for decision making. In fact the use of computers in analysis and modelling is even more critical because of the large volume of calculations and manipulations which cannot be done manually. Virtually every medium and large size municipality has used computers in analyzing information for planning purposes.

The following is a brief description of some of the common analyses performed by computers.

Matrix Manipulation

Once data is stored in a proper statistical and organized manner, it can be easily manipulated. Matrix manipulation is one of the common exercises planners have to do. For example, a matrix could show percentage distribution of retail sales for various stores in the city. A planner could manipulate this matrix for various forecasted values in order to estimate the market share of various existing and proposed stores. Similar and other types of manipulations can be done with other types of data. Computer programs can be either developed in house or bought as a package to perform these exercises.

Statistical Tests

Computers can also be effectively used in performing statistical tests and obtaining statistical indicators such as standard deviation, Chi Square, etc. on given data. In most cases, statistical tests are part of a larger statistical exercise such as modelling. However, where the objective is to simply browse or probe data in order to test a certain hypothesis (for example, the hypothesis that the rental crisis is the result of its relationship to variables such as interest rates, vacancy rates, number of rental starts, etc.), a number of statistical manipulations may be required. There are a number of software packages which can be used for such manipulations.

One of the most widely used packages is the Statistical Package for Social Sciences (SPSS). For a given data base, this package can be used to aggregate statistical parameters for any given variable. Another package, MINITAB, can be used to yield maximum/minimum values of variables, the mean value, the standard deviation, kurtosis, and other statistical values.

Geographic Analysis

There are many other analyses that can be particularly useful. However, most of them can only be performed if data elements can be geographically identified. For example, if data has certain spatial idenitifiers such as street addresses or co-ordinates obtained from digitizing or geoprocessing, it is possible to perform cluster or point-in-polygon retrieval analysis. The cluster analysis yields spatial statistics and allows statistical comparison between the cluster of two spatially identified variables. The point-in-polygon retrieval permits data summarization by any polygon or set of polygons superimposed spatially over the data set.

The use of computer in analysing data from remote sensing[1], incidently, is becoming increasingly important. Remote sensing is now a powerful tool which can provide timely land use inventories for urban and regional planners. Monitoring of urban changes and modelling of urban trends have been transformed from purely academic and long range planning exercises to important factors in (short term) economic decision making. Remote sensing techniques provide practical assistance to meet this need. As new technologies for satellite and data systems handling develop, application of remote sensing in urban and regional planning will increase further. Many state and local governments in the U.S. are now incorporating remotely sensed data into geographic information systems. For example, changes detected periodically may be used to update census statistics or to predict further growth trends.

[1] Methodology of obtaining earth features from orbital and suborbital altitudes in various wavelengths of the visible and nonvisible light spectrum. Remote sensing devices include cameras, lasers, radio frequency receivers and radar systems. Remote sensing produces electronic recording which can be directly fed into a computer.

2.1.3 Modelling

This term is very loosely defined and interpreted. To some people, all computer programs are models. This is not so. Conceptually, all models are made up of computer programs whereas all programs are not models.

In very simple terms models can be defined as mathematical relationships which tend to describe, as closely as possible, real world relationships between different variables. Usually a relationship is assumed and a model is run on historical data to produce results. The results are then compared with the actual data. Adjustments are made to the mathematical relationships and a model is run again. This process is called calibration and each run is called an iteration. After a number of iterations, the results produced by the model come within the acceptable limits (say 5% variance) of actual data.

At this stage, a model is considered to be calibrated. It can then be applied to produce future results on the basis of existing or assumed data.

The subject of computer models is very broad and cannot be fully discussed in this report. However, some basic concepts are discussed. In very broad terms, computer models are employed to achieve one of the following results:

- to get a forecasted value from various independent variables such as determining future levels of population and employment on the basis of birth/death rates, age structure, industrial growth rate, structure of employment, etc.
- to allocate or distribute given totals of, for example, population, retail sales[1], etc., spatially in a given area on the basis of pre-defined zones. This is done on the basis of some measure of attraction, centrality or weight that can be given to a particular zone. However, these models work best where factors influencing the spatial distribution of an activity can be quantified or measured. Factors not quantifiable (e.g. political), are not suitable for incorporation into the structure of a mathematical relationship and can cause severe constraints on its validity.

Another aspect of such spatial models is that they assume that the same factors which influenced the distribution in the past will continue to influence the future distribution of activities as well. However, in actual fact, some of the factors may cease to influence and, on the contrary, new ones may crop up. For example, substantial and unanticipated shifts in the cost of transportation or a new mode of travel can render a model ineffective.

Computer modelling techniques can be used in a variety of other areas in planning. For example, there are urban simulation models which are based on 'gaming' techniques in which human participants interact with a mathematical model in order to simulate a real world phenomenon.

2.1.4 Computer Mapping and Graphics

The use of a computer in graphics is far more complex than normal data processing. Until recently, large computers and large data storage equipment were required for graphics work and thus it was far too expensive for use in many planning departments. However, more recently less expensive mini-computers[2] have become available. These systems usually consist of one or more mini's as central processing units (CPU's), some type of disk storage, and a tape drive all packaged to work as a stand alone system. In addition to the above components, the system requires a work station. These stations provide the means to enter information into the system and verify what was entered. The input work station consists of digitizing boards and CRT[3] display screens. The output components generally are mechanical plotters, screens and printers.

The use of computers in mapping and graphics has been so far limited. There is a shortage of reasonably priced and ready to use software packages. Also, in order to effectively use modern mapping programs a municipality needs to establish a general geographic information system which in itself is a lengthy and complex exercise. Finally, a great deal of effort is needed to convert existing analogue base maps to digital form before any mapping programs can be used. Because of all this, only larger municipalities with sufficient staff and computer resources can effectively use computers for mapping and graphics purposes.

However, use of computers in graphics has been steadily increasing. In the United States, the Synagraphic Mapping (SYMAP) program is currently widely used. As a geoprocessing system, it is simply a display program. The output from SYMAP consists of flat tone or contour mapping on a high speed printer. Dark and light shading is produced by overprinting of characters, minus signs or periods.

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1 See McCabe, Robert. Planning Applications of Retail Models.

2 A computer which is between a microcomputer and mainframe in cost and capability.

3 It is a short for Cathode Ray Terminal. It is connected with the computer and enables visual display of data. Also known as Visual Display Terminal or V.D.T.

In Ontario, the city of Toronto has mapping capability. At present this facility is available in Batch mode only. On-line capability is expected in the future. Regional municipality of Sudbury is in the process of acquiring thematic mapping capability in the near future.

Since the early 1970's most geoprocessing development has resulted in improvements that have allowed planners to handle more data at less cost. Increased access to on-line[1] time sharing[2] and improvements in digitizing, display, scanning and remote sensing have made a wide range of data and techniques available to users.

Computer mapping to be effective in planning must allow the planner to directly interact with the computer to obtain desired results. Interactive graphics systems offer tremendous potential for supporting urban and regional planning applications. They combine the processing power of a computer with graphics display devices in order to provide the planner a visual representation of information. It provides a two-way communication that supplies results or indicates progress for any requested action. It allows the planner to direct the computer, select and retrieve data, perform manipulation and display. The planner thus not only operates the computer but guides the direction of analysis based on each response received from the computer.

2.1.5 Word Processing

Although it is not strictly a planning application, the use of a computer in word processing is a rapidly growing area because the benefits are immediate and more tangible, the cost is very reasonable and it provides an element of flexibility which is very appealing. Word processing offers a substantial saving in office costs, 75% of which are usually labour costs.

In order to meet the needs of very small or very large offices, word processing equipment and systems are available in many sizes and configurations. A word processing unit can be as simple as a typewriter with limited text memory and storage capacity or as complex as a centralized computer system supporting many work stations and storing thousands of pages of text. Every system, however, must be capable of receiving, displaying, storing, and manipulating and modifying text and printing a hard copy. Most word processing systems are fitted with a CRT screen for the purpose of direct text manipulation.

The basic value of a word processing system lies in its capability to perform automatic text editing (to make changes without retyping whole pages), automatic letter writing, automatic page centering, carriage return, column adjustments, automatic title entry and page numbering, and simultaneous input and output.

More sophisticated features are now being added, such as list sorting, forms management, typeface variation, and programming capabilities. In the future, an even more sophisticated use of word processing systems for automatic type setting, telecommunications and electronic mail between offices, image printing, and graphics capabilities will become common place.

2.2 Hardware and Software

Section 2.1 discussed specific tasks where computers are most likely to be used in planning. This section reviews the facilities, especially software packages, which can be used by a planner in order to carry out desired tasks.

In order to make use of computer technology a planner basically needs three types of facilities:

- Hardware: that is, the computer itself,
- Software: programs to run the computer and to analyse information,
- Systems planning and design: to make sure that detailed plans are appropriate and fit together to perform the required system function.

2.2.1 Hardware

Hardware consists of a processor[3], main memory[4], bulk (or auxilliary[5]) storage, peripherals[6] (e.g. printers) and terminals (e.g. visual display units).

Although the choice of hardware is related to the types of applications or tasks to be executed, it is not usually a critical factor. Most mainframes would be quite adequate to execute most planning applications. The choice of a computer is basically a financial decision and depends upon the overall corporate needs of a municipality. For those interested in more

1 Mode of operation (in contrast to off-line) where work is carried out in direct Communication with the computer.

2 When a computer is serving many clients each of them is sharing a portion of its time.

3 Hardware unit which performs arithmetic, controls the sequence of processing and input/output operations and controls access to main memory.

4 Memory directly linked to the processor. It is typically a solid state device like a chip rather than electromechanical (e.g. tape).

5 Storage in addition to main memory including tape, discs and cards.

6 Hardware other than processor. Usually refers to input, output and storege devices.

information on this aspect, the Ministry of Intergovernmental Affairs publication entitled *"Using Computers—A guide for Municipalities in Ontario"* (March 1980) is recommended.

Since on-line applications are now the order of the day, it is important to look into the potential of existing (or to be purchased) mainframes in this respect along with the other criteria.

Some other considerations with respect to hardware are:

i) Would it be feasible or more appropriate to use a micro[1] or minicomputer independently in place of or as a supplement to an available mainframe? If a municipality is small, a low cost micro or a minicomputer may adequately meet all its computing power and data storage needs.

ii) Should the planning department make use of a municipal mainframe[2] or obtain the services of an outside agency? The choice would depend upon:

- existing and anticipated needs of the planning department;
- the extent to which on-line and batch[3] use of the computer will be made;
- existing and anticipated computer and advisory facilities available within the municipality; and
- overall cost.

iii) Should the planning department consider using an intelligent terminal[4] (i.e. a device hooked to a mainframe but which itself has its own processing and storage capabilities—usually a micro computer connected to the municipal, a university or a service bureau's computer) which can meet most of the planning departmen t's storage and data processing needs? and finally,

iv) Is available hardware compatable with available software?

2.2.2 Software

This refers to all those programs which are necessary to operate a computer and to perform desired analysis of the data. They can be divided into four categories.

- Systems Software—programs that control the internal operations of the computer system, such as translation of key board commands or application programs into a form that can be acted upon by the Central Processing Unit (CPU). Systems software usually comes with the hardware and remains permanently stored in the computer. It is also called firmware.
- User Application Packages—Refers to standard, commercially available packages such as SPSS (Statistical Package for the Social Sciences). These packages are written to perform particular planning functions such as urban modelling and forecasting or mapping in a standard format so that they can potentially have a wide general usage.
- Utility Programs—These packages are used to perform the common, repetitive computer program tasks such as copy, sort, dump or create a file of data. These packages are attractive because they are fast and efficient. The benefits of specialized utility packages can be significant where large volumes of file sorting and copying are involved.
- Custom-made Application Programs—Finally, but most important, is custom made software. In fact, custom made programs are almost essential in order to perform many specific planning functions. Custom-made software can be prepared by the programmers of a municipality, a university or a service agency. Since they are tailor made they almost always work best for the municipality.

Commercially Available Packages

There are a number of packages available which can be purchased by planners. Their effective use is, however, a different matter. In choosing a suitable package, a planner needs expert advice from someone who understands the profession and its specific need (e.g. a software consultant or vendor). At present, both good advice and good software may be hard to find.

Whereas packages for large scale operations such as transportation planning or regional resource management are more easily available and widely used, it is difficult to find suitable packages for jobs of a more modest scale.

Computers in Local Government—Urban and Regional Planning" (1980), published by Auerbach Publishers Inc., contains an "Application Software Directory" which is a compilation of applications software packages

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1 A complete small computer consisting of a processor, memory and input/output capability. Basic components are on micro chips. The cost is very modest.

2 Large computers. Usually supplied by long established computer manufacturers with a comprehensive range of application software and services. The cost is high.

3 The earliest form of data processing in which programs and related data are gathered together in batches. The work is performed in sequence down the batch queue.

4 A device which can be linked to a computer but which also incorporates its own processing and storage capabilities.

designed specifically for use in urban and regional planning activities. Although it may not include all the available programs, this directory provides the most comprehensive and up-to-date listing of commercial, university developed and government produced planning software packages. The publication also includes many useful articles on various aspects of the use of computers in urban and regional planning, case studies and hardware selection and evaluation.

The directory is divided into ten categories by application. The categories are:

		No. of Packages Listed
1.	Census Data Manipulation	5
2.	Community Analysis and Planning	13
3.	Environmental Impact Assessment	6
4.	Fiscal Impact Assessment	9
5.	Forecasting	9
6.	Geographic Data Analysis/Geographic Information Systems	3
7.	Land Use/Land Resources Planning	12
8.	Mapping/Graphics	56
9.	Statistical Analysis and Data Manipulation	15
10.	Transportation Planning	9

For each package listed, the following information is provided:

- Package description (e.g. what it does, vendor's name, etc.)
- Operating environment (e.g. hardware requirements).
- System operation (e.g. mode of operation).
- Cost, terms and conditions.
- Service and support (e.g. conditions of support, training, etc.).
- Representative sites (e.g. cities, counties using the package).

2.2.3 Systems Planning and Design

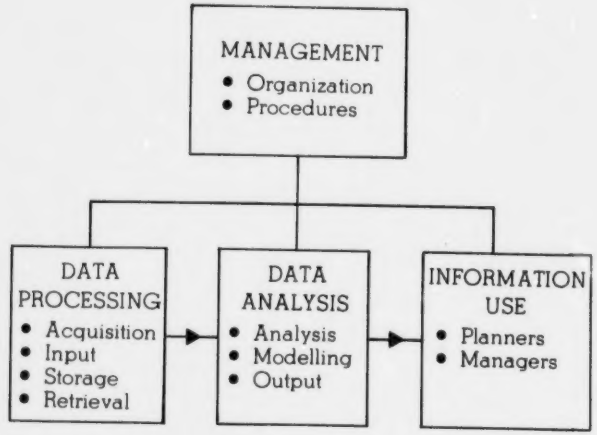
This aspect is very important. It involves the systematic and detailed *design of objectives* to be achieved so as to ensure that detailed plans for each part of the system are appropriate and fit together.

The elements of an overall system as described in Auerbach's publication "Computers in Local Government" are:

- Management Sub-system—It is made up of the organization, staff and procedures and rules for determining the direction of one or more of the other three sub-systems.
- Data Processing Sub-system—This sub-system handles data acquisition, input, storage and retrieval by a series of operations utilising automated and non-automated procedures. The data base is part of this system.
- Data Analysis Sub-system—It handles manipulation of data. It enables the selective retrieval of data so that required analyses and modelling exercises can be done. The sub-system also prepares data for output in various forms.
- Information Use Sub-system—This serves as the user's decision-making system where the information is brought to bear on a particular problem.

It should be noted that in most cases only two sub-systems (i.e. Data Analysis and Data Processing Sub-systems) are really developed on a formal and computerized basis.

The following diagram shows the relationship between the four sub-systems in a formalized setup.



3. Municipal Survey Results

In September 1981 a letter was sent to all the Planning Directors in Ontario requesting information on what planning functions are being assisted in their departments by computers and the nature of the hardware and software in use.

A total of thirty-two (32) planning directors responded. Of these eighteen (18) expressed an interest in discussing the use of computers in their planning departments. The remaining fourteen (14) showed an interest in our study but did not seek to participate in the survey at the time.

The following list indicates the names of the municipalities who were interviewed.

1. Regional Municipality of Durham
2. Regional Municipality of Haldimand-Norfolk
3. Regional Municipality of Halton
4. City of Kitchener
5. City of London
6. Municipality of Metropolitan Toronto
7. City of North York
8. City of Ottawa
9. Regional Municipality of Ottawa-Carlton
10. Regional Municipality of Peel
11. City of Peterborough
12. Sault Ste. Marie Planning Board
13. Regional Municipality of Sudbury
14. Town of Stoney Creek
15. City of Thunder Bay
16. City of Toronto
17. Regional Municipality of Waterloo
18. City of Windsor

In the following section, the information obtained from the 18 municipalities interviewed is analyzed in order to determine what planning functions are being assisted by the use of computers at the present time and the nature of the hardware and software in use.

Summary of Interview Information

The interviews were conducted on the basis of a written questionnaire. The questionnaire (see Appendix) had four parts: hardware, software, planning applications and general information. Information from each part is aggregated and presented in the form of a table for easy and quick reference. Since the nature of the information tends to vary from one municipality to another, explanatory footnotes have been provided at the end of each table.

3.1 Computer Hardware

Table 1 provides a summary of hardware in use. Hardware details are given **only** if a computer is physically located in the planning department, except for the City of Toronto where the use of the central computer by the planning department appears to be very substantial. For other municipalities, the details of the hardware shared by the planning departments are given in the corresponding footnotes[1]. In cases where the department shares or contracts out services to an outside agency, the details of the hardware have been omitted. However, if it is directly connected to an outside computer, details of in-house terminals are given in the table.

The following are some of the main findings from the survey on the computer hardware in use.

a. In general, planning departments do not have an exclusive use of a mainframe. They either share a municipal mainframe usually located in the finance department or use an outside computer facility such as of a service bureau or a university. Nevertheless, there are presently three trends:

- As computers are now able to simultaneoulsy run many programs and provide services to many users at the same time, planners have increasingly better access and more effective use of available mainframes.
- On-line facilities are now available in municipalities. Many departments including planning are setting up terminals in order to have quick retrieval and direct manipulation of stored information.
- Primarily due to their fairly low cost and easy use, micro computers are becoming increasingly popular as either stand alone or as an intelligent terminal (i.e. connecter to a mainframe).

b. Two municipalities use micro computers in their planning department and one has a mini computer. All others have no in-house computer in their planning departments.

c. Four municipalities do not use their municipality's central computer. All the others use the mainframe. The degree of use varied enormously. For example, the Town of Stoney Creek, and the City of Peterborough seem to make minimum use of the central computer while the City of Toronto and the Regional Municipality of Sudbury make substantial use of the central computer.

[1] Hardware details for all Ontario Municipalities are covered in "1981 DIRECTORY OF COMPUTERS AND APPLICATIONS IN ONTARIO MUNICIPALITIES", (1981), published by Ministry of Municipal Affairs and Housing.

d. Five municipalities utilize outside private agencies extensively for their computing needs. Another five municipalities use a university's computer, of which four use the University of Waterloo computer. The Ministry of Transportation and Communications' computer is also used by four of the municipalities surveyed.

e. Fourteen municipalities have an in-house terminal connected to a municipal or an outside mainframe. In most cases, it consists of a CRT terminal, with or without a printer.

f. The City of Toronto is the only municipality having its computer linked to other municipalities.

g. Most municipalities are satisfied with the computers they are using, except the City of Ottawa which is dissatisfied with its mini computer. The three municipalities which use micro computers are satisfied.

h. Most municipalities have both on-line and batch mode operations. Six municipalities depended upon mainly batch mode application. The degree of on-line application varied enormously, the most intensive use being in the City of Toronto Planning Department.

i. IBM mainframes (Models 370, 4331, 4341, and Systems 3) are being used in eight municipalities. Honeywell computers are being used in two municipalities and two others are switching to Honeywell from their existing Philips and IBM mainframes. Others in use are Amdahl, Univac, Eclipse, and Philips.

Municipal Interview Questionnaire — Summary of Computer Hardware

Table 1

Municipality	Computer Owned, Rented, Shared, etc.	With Whom?	Purchase Date and Cost	Description of Hardware in Use								Mode of Operations	Comments	Footnote
				CPU make and Model	CPU Capacity	Channel Capacity	Storage Details	Control Devices	Input Devices	In-House Facilities	Output Devices			
1. Metropolitan Toronto	• share • rent	• City of Toronto	N/A★	N/A	N/A	N/A	N/A	N/A	3278 CRT Terminal	• yes	• Deck Writer • L20 Printer	• both	• could use a micro • biggest problem with city terminal is delay • not entirely satisfied	1
2. Regional Municipality of Peel	• contract out	• Data Crown • York/ Ryerson computing centre • City of Mississauga • MTC★★	N/A	IBM IBM Univac IBM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• lack of on-line facility at present	2
3. City of Ottawa	• own • share • contract out	• Municipal • City of Toronto • several different firms	3 years ago for $80,000	IV Phase Mini Computer	N/A	N/A	N/A	N/A	CRT Terminal	• yes in-house terminal linked to Toronto computer	CRT Terminal	• Mainly Batch	• municipal computer planning programs in the development stages • not fully satisfied with the mini computer — limited software, frequent down time	3

★ Notation N/A in this and subsequent three tables should be interpreted as item "not applicable" or information "not available".

★★ Ministry of Transportation and Communications.

Municipal Interview Questionnaire — Summary of Computer Hardware

Table 1 (Cont'd)

Municipality	Computer Owned, Rented, Shared, etc.	With Whom?	Purchase Date and Cost	Description of Hardware in Use								Mode of Operations	Comments	Footnote
				CPU make and Model	CPU Capacity	Channel Capacity	Storage Details	Control Devices	Input Devices	In-House Facilities	Output Devices			
4. Regional Municipality of Haldimand-Norfolk	• share	• University of Waterloo	N/A	N/A	N/A	N/A	3 discs USR 191 Model 3350 capacity 46000 characters per disc	N/A	keyboard Volker Craig KBI Data Max Couplers AC103	• yes	printer Data Max 1100 AKSR 45 cps screen 404 Volker Craig	• mainly on-line • some batch work	• contact with Waterloo is via Data Pac. This arrangement is not satisfactory. Problems with static on the line, down time high • thinking of getting a mini and acquiring word processing capability	4
5. City of Toronto	• lease • contract out	• IBM	recently	Amdahl 470/V6 II	8 mega bytes	11 channels with total 16 mega byte capacity	N/A	tape and disc controllers #s 3803, 3274, 3880, 8000, 3791	5 tape drives 165 screens 8 disc drives	• yes	printers screens plotters	• both	• generally satisfied	5
6. City of London	• share	• City computer	N/A	N/A	N/A	N/A	N/A	N/A	CRT Terminal	• yes	CRT Terminal	• both	• city considering a major upgrading of their central computer	6
7. City of Thunder Bay	• share	• City computer	N/A	N/A	N/A	N/A	N/A	N/A	CRT Terminal	• yes	CRT Terminal	• both	• quite satisfied • no major changes anticipated	7

Municipal Interview Questionnaire — Summary of Computer Hardware

Table 1 (Cont'd)

Municipality	Computer Owned, Rented, Shared, etc.	With Whom?	Purchase Date and Cost	Description of Hardware in Use								Mode of Operations	Comments	Footnote
				CPU make and Model	CPU Capacity	Channel Capacity	Storage Details	Control Devices	Input Devices	In-House Facilities	Output Devices			
8. City of Sault Ste. Marie	• own • share	• City Computer • Univ. of Waterloo	recently for $7,240	Apple III	128K	N/A	N/A	N/A	accoustic couplers 2 floppy disc drives Apple screen also hooked to Waterloo	• yes	one CRT terminal hooked to city computer QUME printer	• both	• had problem of cross-talk with the city computer • city computer is in the process of being upgraded • all input/output devices for city system are Data General	8
9. Regional Municipality of Durham	• share	• Canada Systems Group	N/A	N/A	N/A	N/A	N/A	N/A	CRT Terminal	• yes	CRT Terminal	• both	• at present satisfied	9
10. Town of Stoney Creek	• share	• other departments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• yes	Printer	• on-line	• in the process of upgrading Town's central computer • looking at word processing capability • possibility of getting regional information on computer	10
11. City of North York	• share • rent • contract out	• city computer • York Univ. • Metro	N/A	N/A	N/A	N/A	N/A	N/A	CRT (32) model 3278	• yes	character printer model 3287 stage 2	• both	• no problems	11

Municipal Interview Questionnaire — Summary of Computer Hardware

Table 1 (Cont'd)

Municipality	Computer Owned, Rented, Shared, etc.	With Whom?	Purchase Date and Cost	Description of Hardware in Use								Mode of Operations	Comments	Footnote
				CPU make and Model	CPU Capacity	Channel Capacity	Storage Details	Control Devices	Input Devices	In-House Facilities	Output Devices			
12. Regional Municipality of Ottawa-Carlton	• lease • share • contract out	• other departments	1975 at $16,000 per year		N/A	N/A	N/A	N/A	2 CRT (IBM) Terminals	• yes	CRT (2)	• both	• satisfied with micro • hope to get a printer in the Planning Department • dissatisfied with main frame, takes too long, very severe limitations on the software	12
13. Regional Municipality of Sudbury	• share	• City of Sudbury & Sudbury Hydro Commission	N/A	N/A	N/A	N/A	N/A	N/A	Screen & Typewriter	• yes	screen	• mainly on-line; some batch work	• In general satisfied • application software is limited	13
14. City of Peterborough	• share • contract out	• City computer • Trent Univ.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• no	N/A	• batch	• generally satisfied	14
15. City of Windsor	• share	• other departments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• batch	• no comment	15
16. City of Kitchener	• share • contract out	• share with other departments and Region • contract with Univ. of Waterloo	N/A	N/A	N/A	N/A	N/A	N/A	IBM 57628 CRT	• yes	IBM CRT	• both	• making use of computers effectively	16

Municipal Interview Questionnaire — Summary of Computer Hardware

Table 1 (Cont'd)

Municipality	Computer Owned, Rented, Shared, etc.	With Whom?	Purchase Date and Cost	Description of Hardware in Use								Mode of Operations	Comments	Footnote
				CPU make and Model	CPU Capacity	Channel Capacity	Storage Details	Control Devices	Input Devices	In-House Facilities	Output Devices			
17. Regional Municipality of Halton	• own • share	• share word processor with other depts. • share with MTC	May 1982 for $10,000	Radio Shack TRS80 II	64K	N/A	N/A	N/A	Keyboard	• yes	printer hooked to MTC TRS daisy wheel printer II	• mostly batch	• satisfied with micro • trying to get another Radio Shack	17
18. Regional Municipality or Waterloo	• share • rent	• share with other departments • rent from: Univ. of Waterloo City of Kitchener MTC Region of Peel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• no	N/A	• batch	• not entirely satisfied with present situation • plan to have a terminal in house • use municipality's main frame extensively	18

Footnotes:

1. Metro Planning Department is directly linked to City of Toronto's mainframe (i.e. Amdahl V6 II). It has also used IBM370 and IP Sharp Computers.
2. Region of Peel has purchased a DEC mini computer with one terminal located in planning. The Planning Department is of the opinion that planning applications generally do not lend themselves to batch applications. Planner should have direct and on-line access to computer. The department is using Data Crown Service Bureau for the implementation of RISC project.
3. City of Ottawa lease-purchased IBM 4331 mainframe sometime in 1980. The Planning Department shares it. The city computer is still in developmental stages. The department is not fully satisfied with its mini computer it purchased 3 years ago. The company did not develop good word processing programs.
4. The Planning Department is on-line with IBM370 at the University of Waterloo. However, it has to go through Data Pac on Watts line (special Bell Telephone line). The department expenences great difficulties with this arrangement. Quality of output on printer and screen is rather poor. Using telephone lines is also expensive. Down time is high due to possibility of breakdown at either Data Pac or the university computer. Thinking of purchasing word processing and own mini computer in the future.
5. City of Toronto is planning to replace existing computer with another Amdahl Computer of higher capacity. The department is of the opinion that hardware decisions should be left to management people. Planning staff should not be involved too much in it. Cost of providing service to public is high with complex equipment.
6. City of London has leased a Univac 9030 since 1978 for $15,000/month. Core capacity is 512K, auxiliary capacity 1.2 billion bytes. Disc drives, tape drives, printers and screens constitute input/output devices.
7. The City of Thunder Bay purchased IBM 4331 in Dec. 1979 for $130,000. The city also leases IBM 4341 at $12,000/month. Capacities on IBM 4341 are 4 and 8 megabytes respectively. Input/output devices include card reader, disc drives, printers, CRT's, and tape drives.
8. The Planning Department uses City's Data General Eclipse C330 and University of Waterloo's IBM 370/75 computers. City's computer cost $350,000. It has 320K core and one megabyte auxiliary capacity. Input/output devices are all IBM.
9. The Department shares Canada Systems Group's IMB 370 computer.
10. The Town bought a mini computer (Philips 430) in 1979 for about $80,000. The computer has 120K core and 40 megabyte auxiliary capacity. Input/output devices include disc drives, CRT, and printers. The Town is planning to purchase a new computer (Honeywell DPS6/48) which will provide 256-1024K core capacity and 80 megabytes auxiliary capacity. There will be up to 40 work stations.
11. The City of North York has rented IBM 4331 since 1980 at a cost of $150,000 annually. The computer has one megabyte core capacity. Input/output devices include IBM disc drives, diskette readers, card readers, tape drives, CRT terminals, and printers. The City has also leased a Micom M2001 VDU word processing equipment since 1981 at a cost of $7,000/year with option to purchase. In addition to having access to both (i.e. City's computer and word processor), the Planning Department also makes use of Metro Planning Department services.
12. The Planning Department uses Region's main computer (IBM systems 3) purchased recently (was being rented for the past 10 years) at a cost of $331,000. The computer has a core capacity of 512K. Input/output devices are all IBM. The Planning Department contracts out bulk of its services. The department makes efficient use or word processing equipment which has programming capacity. The department expects to establish communication link with Canada Systems Group.
13. The Region, City and the Hydro Commission of Sudbury jointly lease the mainframe. The mainframe (Honeywell DPS/66) has a capacity of 1100 megabytes, auxiliary capacity is 800 megabytes. Input/output devices consist of Honeywell card readers, tape drives, CRT terminals, and printers. Planning Department also makes use of Region's word processing equipment.
14. The Planning Department uses City's mainframe (IBM Systems 3/15D) bought in 1979 for $200,000. Input/output devices are on lease at $4,000/year. Core capacity is 384K; auxiliary 500 megabytes. IBM Input/output units. The Department has used Trent University's services. City planning to upgrade to probably Honeywell DPS6 or 7.
15. The Planning Department uses City's mainframe (Univac 1100/60) which is on lease. Core capacity 524K auxiliary 1700 million bytes/disc and 1600 bytes per inch on tape. Input/output facilities consist of Univac Card Readers, tape drives and printers.
16. The Planning Department share City's mainframe (IBM 370/138). It was purchased for $90,000 in 1979. Core capacity one megabyte, total capacity 1280 megabytes. All IBM input/output devices. The City is thinking of upgrading in 1983.
17. The Planning Department shares MTC's mainframe. It also shares Region's Micom word processor with other departments. Think that micro's are effective and economical for small to medium size planning jobs.
18. The Planning Department shares Region's central computer (Honeywell DPS4) just recently leased at a cost of $34,500 for 1982. There is a maintenance contract at $480 for 1982. The input/output units are all Honeywell. Hope to transfer RISC data from Peel's to Region's own mainframe. University of Waterloo computer is used for transportation plan review.

3.2 Computer Software

Table 2 provides a very brief description of the software packages being used in the 18 surveyed municipalities. Some information is given in the footnotes but for details, individual departments should be contacted.

There are 31 different programs or packages which are being used by the planning departments in the 18 municipalities surveyed.

The 31 programs and packages can be roughly broken down into the following categories:

- Community Analysis and Planning — 3 packages
- Forecasting — 5 packages
- Geographic Data Analysis/ Geographic Information Systems — 6 packages
- Land Use and Land Resource Planning — 4 packages
- Statistical Analysis and Data Manipulation — 5 packages
- Transportation Planning — 8 packages

Fourteen of these packages were produced by consultants, six were prepared in-house, seven by the province, one by the University of Toronto and three by an unknown source. Four of these packages (i.e. SAS, SPSS, UTPS, and SCOPE) are listed in the AUERBACH's "Application Software Directory" refered to earlier in the report.

None of the municipalities indicated they had any programs or packages for the following functions.

- Census Data Manipulation
- Environmental Impact Assessment
- Fiscal Impact Assessment
- Mapping and Graphics

The following are some general observations from the survey of programs and packages in use.

a. There are about a half dozen commercially available software packages which are being used by various planning departments. Many of the packages in use have been developed in-house, such as the Metro Model and the Demographic and the Development Control package developed by the Regional Municipality of Durham. A number of other packages have been developed by outside agencies such as consultants, universities, and the Province.

b. SPSS (Statistical Package for Social Sciences) seems to be the most widely used package in Ontario. Nearly half of the municipalities interviewed said they used it. RISC (manipulates assessment information) is being used by four municipalities, although others are interested in it for possible use. UTPS (Urban Transportation Planning System) is the second most common package used by municipalities.

c. The use of software packages is mainly limited to demographic projections, storage and retrieval of planning information, manipulation and statistical analysis of data and simulation modelling (mainly retail and transportation).

d. Most municipalities have programming facilities available through their data processing centre. Very few have any programming capabilities within the planning department.

e. Nearly all municipalities were generally or highly satisfied with the packages they used. The Cities of London and Thunder Bay, however, expressed some disatisfaction with the Retail Simulation Model developed by the University of Toronto.

f. Mapping and graphics seems to be the weakest area. None of the municipalities mentioned any mapping package in use (AUERBACH'S "Application Software Directory" lists 12 packages). The City of Toronto indicated they have some mapping capability. The Regional Municipality of Sudbury is at present working on acquiring mapping capabilities.

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
1. Metropolitan Toronto **Contact Person** Mr. Joe Silva, Planner Tel: (416) 367-8130	• TPS	• Transportation modeling	• MTC	• CORDON COUNT	• 1978	• 1978	• 1978	• yes	• FORTRAN	N/A	N/A	• MTC	• require consulting	• generally satisfied	• many regional municipalities	• FORTRAN • APL • PL1	
	• UTPS	• Transportation modeling	• U.S. Dept of Transportation	• U.S. Dept. of Transportation	• 1980	• 1980	• 1980	• dont' know	• don't know	N/A	N/A	• don't know	• require consulting	• generally satisfied	• used in U.S.		
	•CORDON COUNT	• Summenze vehicle counts and produces summary reports	• Metro	N/A	• 1975	• 1975	• 1975	• revised every two years	• COBOL	N/A	N/A	N/A	• require consulting	• generally satisfied	• Peel & Halton		
	• TR1907	• Demographic Model	• IBM	• MTC	• 1970	• 1970	• 1970	• don't know	• FORTRAN	N/A	N/A	• MTC	• require consulting	• generally satisfied	• Peel & Hamilton		
	• PLAN CODE 1	• Matrix manipulation, forecasting sinsitivity, analysis	• IBM	• contract with MBC Inc.	• 1976	• 1977	• 1977	• IBM puts update	• PLI	• $9,000 per yr.	N/A	• IBM service	• require consulting	• generally satisfied	• City of Toronto		
	• RISC*	• creates regional file from assessment information	• RISC	N/A	• 1979	• 1979	• 1979	• yes some	• COBOL	• 2,000 per yr.	N/A	• contract with MBC Inc.	• require consulting	• generally satisfied	• Other Regional Municipalities		

* Regional Information Systems Committee.

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
2. Regional Municipality of Peel **Contact Person** Ms. Kathy Blaydon Manager, Socio-Economic Analysis Section Tel: (416) 791-9400	• SPSS	• allows data file building and multivariate analysis	• U.S.	• use it at Mississauga and York/ Ryerson	• 1960	N/A	• don't know	N/A	• FORTRAN	• No cost	• does a lot but not very neat	• free consulting at York/ Ryerson	• included	• satisfied	• very widely used	• BASIC	1
	• SAS	• same as SPSS but more flexible	• U.S.	• use it at York/ Ryerson	• late 1970's	N/A	• don't know	N/A	• COBOL	• No cost	• none	• support available at York/ Ryerson	• included	• highly satisfied	• widely used in academic circles		
	• RISC	• creates a regional planning file from assessment data	• RISC★	N/A	• 1979	• 1979	• 1980	• one major revision by Peel	• COBOL	• 2,000	• Peel uses generalized retrieval program extensively	• Peel MIS support	• contract with MBC Inc.	• highly satisfied	• region of Waterloo, Metro, Halton and Haldimond Norfolk		
	• TR1907	• projects population, labour force and housing demand and supply, assisted housing and fiscal impact	• MTC & Metro	N/A	• early 1970's	N/A	• don't know	N/A	• FORTRAN	• No cost	• none	• free consulting	• manuals available	• satisfied	• Metro & Hamilton Wentworth		
	• RTPS	• transportation model	• don't know	• don't know	• don't know	• don't know	• don't know	N/A	• FORTRAN	• No cost	• none	• MTC	• don't know	• don't know	• don't know		

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
3. City of Ottawa **Contact Person** Mr. Barry Nabatian, Senior Asst. Planner Tel: (613) 563-3181	• SCOPE	• commercial simulation model	• Decision Science Corp.	• Pensylvania	• 1974	• 1974	• early 1975	• added new demographic sub-models	• FORTRAN	• $105,000	• strictly planning application	• consulting service available	• require consulting serice	• satisfied generally	• Calgary has a modified version	• FORTRAN • COBOL & capacity for other languages	2
	• URBAN INFORMATION SYSTEM (UIS)	• storage and retrieval of planning information	• Consultants, Lafloon Belaire Ass.	N/A	• 1976	N/A	• 1976	• several to make it efficient	• COBOL	• $66,000	• Info. used by other depts.	• city assistance	• require specialised consultation	• pretty satisfied	• the package was obtained		
	• CENTRAL AREA DATA BANK	• detailed data storage and retrieval	• In-house	N/A	• 1980	N/A	• 1980	• many revisions	• BASIC	N/A	• Strictly planning application	• city assistance	• require specialised assistance from Data Centre	• highly satisfied	• similar package used by cities of London, Calgary & Edmonton		
4. Regional Municipality of Haldimand Norfolk **Contact Person** Mr. John Coopmans Planner Tel: (416) 772-3337	• SPSS	• statistical analysis of social data	• U.S.	• use it at the Univ of Waterloo	• 1960's	N/A	• don't know	• periodic revisions	• FORTRAN	N/A	N/A	• Univ. maintains it	• included	• very useful	• no	• COBOL & some FORTRAN	3
	• RISC	• produce standard reports and planning information	• MBC Inc.	• N/A	• 1979	• 1979	• 1980	• RISC has made revisions	• COBOL	• don't know	• useful if information available	• RISC, also Univ.	• no	• satisfactory	• Peel, Waterloo Metro		

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
5. City of Toronto **Contact Person** Mr. Alan Mitchell, Planner Tel: (416) 367-7185	• SAS	• provides statistical analysis e.g. regression and manipulation or raw data	• SAS Inc. North Carolina	• SAS Inc.	• late 1970's	• 1981	• 1981	• not sure	• COBOL	• not sure	• runs on IBM 360/370 machine compatable to AMD-AHL, ITEL, CDC, Omega	• supported by manufacturer	• require consulting and the manual	• highly satisfied	• Univ. of Tor.	• PL1 • APL	4
	• EXTRACTO	• information retrieval and reporting system	• Aquila B.S.T. Ltd.	• from Aquila	• late 1960's	• mid 1970's	• don't know	• not sure	• don't know	• don't know	• none	• not sure	• not sure	• not sure	• don't know		
6. City of London **Contact Person** Mr. J. Tikalsky Planning Admin. Tel: (519) 679-4980	• RETAIL SIMULATION	• inpact on sales: retail dollars per sq. ft.	• Univ. of Toronto	• from TEICA	• 1974	• 1976	• 1976	• one in 1980	• FORTRAN	• none	• none	• none	• no	• not completly satisfied	• no	• no	5
7. City of Thunder Bay **Contact Person** Mr. Philip Wong Senior Planner Tel: (807) 623-2711 ext. 2527	• SPSS	• statistical manipulation	• SPSS Inc.	• SPSS Inc.	• don't know	• 1979	• 1979	• continuous	• FORTRAN	• $2,700/year	• none	• no support from SPSS Inc.	• instructions included in package	• satisfied	• don't know	• very little in APL	6
	• RETAIL SIMULATION	• Inventory of retail space and impact of retail upon other vanables	• Univ. of Toronto	• Univ. of Toronto	• don't know	• 1980	• 1980	• none	• FORTRAN	• none		• IBM provides consulting service	• manual available	• lots of bugs in the package	• don't know		

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
	• APLD1	• suitable for producing a small data base	• IBM	• IBM	• don't know	• 1980 (rental)	• 1980	• continous revisions	• APL	• $350 /month	• none	• IBM provide consulting services	N/A	• satisfied	• no		
8. City of Sault Ste. Marie **Contact Person** Mr. Don Mconnel Planner Tel: (705) 949-9111	• VISICALC	• Matrix manipulation	• Personal software	• Apple dealer	• 1978	• 1982	• 1980	• revised by Apple	• MACHINE LANGUAGE	• $270	• none	• support from Apple dealer	• none	• pretty good	• no	• Basic • COBOL	
	• DESKTOP PLAN	• Simplifies work calculations	• Personal software	• Apple dealer	• 1978	• 1980	• 1980	• revised by Apple	• BASIC	• $270	• manual well written	• support from Apple dealer	• teaching package available	• pretty good	• no		
	• POP. EMP MODEL	• Population, and Employment projections	• Internally	• N/A	• 1982	N/A	• 1982	N/A	• BASIC	N/A	• need 32K machine to run smallest version	N/A	N/A	• excellent	• no		
	• PFS	• Data Management System	• Software Publishing Corporation	• Apple dealer	N/A	N/A	N/A	N/A	• PASCAL CODE	• $375	N/A	• Apple dealer	N/A	• satisfied	• no		
	• APPLE WRITER III	• Word processing System	• Apple	• Apple dealer	N/A	N/A	N/A	N/A	• BINARY CODE	• $310	N/A	• Apple dealer	N/A	• very good	• no		
	• APPLE ACCESS III	• Communications	• Apple	• Apple dealer	N/A	N/A	N/A	N/A	• PASCAL CODE	• $195	N/A	• Apple dealer	N/A	• very good	• no		

Municipal Interview Questionnaire — Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
9 Regional Municipality of Durham **Contact Person** Dr. Moteed Micheal, Commissioner of Planning Tel: (416) 668-7731 ext. 50	• ASSESSMENT INVENTORY	• takes information from assessment & prints it in a desired format	• it was contracted out	N/A	• 1980	• 1980	• 1980	• yes revised to do additional reports	• COBOL	• $3,000	• program maintenance done in house	• reasonable documentation was given	• require technical Personnel to maintain it	• very satisfied	• no one	• COBOL • FORTRAN • APL	7
	• RISC	• produces standard reports and planning information	• MBC Inc	N/A	• 1979	• 1980	• 1981	• revisions being planned	• COBOL	• shared cost	• none	• supported internally	• manuals available	• satisfactory	• Peel, Metro		
	• IBM MOD	• gives travel projections	• IBI consultants	• IBI	• Late 1960's	• 1976	• 1976	• no	• FORTRAN	• free	• none	• MTC can provide service	• need to have working knowledge	• generally satisfied	• MTC		
	• UTPS	• manipulates data	• MTC	• MTC	• 1972/73	• 1976	• 1976	• MTC has done revisions	• FORTRAN	• free	• none	• support available	• requires computer knowledge	• satisfied	• Metro, Peel, Hamiltpm, Wentworth, Halton, Ottawa, Carlton, MTC		
	• DEV CONT PROGRAM	• monitors plans of subdivision by area municipality (e.g. no. of units pop. etc.)	• In house	• In house	• 1981	• 1981	• 1981	• no	• PL1	N/A	• none	• supported internally	N/A	• satisfied	• similar package done in other municipalities		

Municipal Interview Questionnaire
Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
9. Regional Municipality of Durham (Cont'd)	RETAIL PROGRAM	• I) an al location gravity model II) integer processing III) entropy, maximisation	• details not available	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• none	N/A	N/A	N/A	N/A		
	DEMOGRAPHIC MODEL	• pop. forecasts migration rates, cahort survival	• In-house	N/A	• 1978	N/A	• 1978	• FORTRAN		N/A	• none	N/A	• difficult without support	• satisfied	• no		
10. Town of Stoney Creek	NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
11. City of North York **Contact Person** Miss Ruth Bower Planner Tel: (416) 224-6126	RISC	• producers reports from assessment information	MBC Inc.	package owned by Metro	N/A	N/A	N/A	N/A	• COBOL	N/A	N/A	Metro support	N/A		N/A	• COBOL FORTRAN	8
12. Regional Municipality of Ottawa-Carleton **Contact Person** Mr. Joseph Phelan, Planner Tel: (613) 563-2824	SPSS	• Statistical analysis of data	• SPSS Inc. Chicago, Illinois	• Service Bureau owns it	• Early 1970's	• 1974	• Was operated in 1974	• Update by producer	• FORTRAN	N/A	• No	• Support through Service Bureau	• Program courses and manuals available	• Highly satisfied	• Transportation Department	Some programming done through Finance Department	
	MARK IV	• Text oriented produces reports and tables from data files	• Dont know	• Owned by Canada Systems	• Don't know	• Since 1975	• Don't know	• Don't know	• MARK IV Own language	• Pay for use	• No	• Supported by Consultant	• Don't know	• Highly satisfied	• Don't know		

Municipal Interview Questionnaire
Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
12 Regional Municipality of Ottawa-Carleton (Cont'd)	• UTPS	• Traffic model Department uses it for matrix manipulation and storage of data	• UTPS inc	• Purchased by Transportation Department	N/A	N/A	• Don't know	• Don't know	• FORTRAN	N/A	• No	• Supported by Transportation Department	• Don't know	• Satisfied			
	• POP. PROJECTION	• Population forecast model	• Univ of Chicago	• Canada Systems	• 1974	• 1979	• 1979	• No	• FORTRAN	• Free	• No	• No	• Have manuals to use	• Satisfied	• No		
13 Regional Municipality of Sudbury **Contact Person** Mr. David Hughes, Chief Cartographer Tel (705) 673-2171	•MANOR LEVELOB	• Analysis of horizontal control survey network	• Prov of Ont (MNR)	N/A	• 1981	• 1981	• 1981	• No	• FORTRAN	N/A	• No	N/A	• No	• High	• No	COBOL 74 FORTRAN IV SPSS BASIC	9
		• Population projections	• Reg Municipality of Sudbury	N/A	• 1979	N/A	• 1979	• No	• FORTRAN	N/A	• No	N/A	• Not required	• Good	• No		
	• SPSS	• Statistical Analysis	• SPSS Inc	• Univ of Kansas	• 1978	• 1978	• Don't know	• No	• FORTRAN	• $2000	• No	• None	• Manuals available	• Satisfied			
14 City of Peterborough **Contact Person** Ms. Dawn Mernum, Planner Tel: (705) 742-7771	• SPSS	• Cross tabulations	• Don't know	• Don't know	• Don't know	N/A	• Don't know	• Don't know	• FORTRAN	N/A	• No	• Don't know	• Don't know	• Very Satisfied		COBOL RPG	10
15 City of Windsor	NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	RPG	11

Municipal Interview Questionnaire
Summary of Computer Software Packages

Table 2 (Cont'd)

Municipality	Program and Packages		Produced by	Purchased From	Year Available	Date Bought	Operational Date	Revisions Done	Language used	Purchase Cost	Other Details	Support Services	User Training	Satisfaction	Other Users	Details of In-House Programming	Foot Note
	Name	What it Does															
16. City of Kitchener **Contact Person** Mr. Brock Stanley, Director of Planning Tel: (519) 885-7115	• SPSS	• Statistical Analysis	• Don't know	• Don't know	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• satisfied	• Don't know	• COBOL	12
	• TRANSPORTATION MODEL	• Establishes network and shortest distance between nodes	• Public Tech. Inc. Washington	• Public Tech. Inc.	• 1977	• 1980	• 1977	• No .	• FORTRAN	• $6000	• No	• no support	• No	• highly satisfied	• Oshawa and Region of Waterloo		
	•REGIONAL PACKAGES	• Include retail impact and population forecast models	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	• satisfied	• Region of Waterloo		
17. Regional Municipality of Halton **Contact person** Ms. Pat Herring Planning Asst. Tel: (416) 827-2151 ext. 311	• STP	• Transportation modelling	• MTC	• MTC	• 1971	• Don't know	• Don't know	• MTC	• FORTRAN	• $6000	• No	• Supported by MTC	• MTC can be consulted	• satisfied	• Regional Municipality of Peel	• FORTRAN BASIC	13
18. Regional Municipality of Waterloo **Contact Person** Mr. Frank Watty Director of Planning Tel: (519) 885-9400	SYSTEMS 33	• Traffic forecast model	• MTC	• MTC	•1975/76	•1975/76	•1975/76	• Some minor revisions	•COBOL	N/A	• None	• MTC	• Available from MTC	• satisfied	• Regional municipalities of Niagara, Hamilton-Wentworth, Ottawa-Carleton, and Metro	•COBOL	14
	RETAIL IMPACT MODEL	• Determine retail impact of centres	• Min of Housing	• Min of Housing	• 1974	N/A	N/A	•Improved versions now available	N/A	• No cost	• None	N/A	N/A		• Don't know		

Footnotes:

1. The Planning Department would prefer to have METRO MODEL on line. FORTRAN programming is done in the Transportation Division. Planning department is considering acquisition of QUEFY/QTEXT and perhaps TM'AKER II a VISICALC type package which has modelling capabilities.

2. SCOPE program is more suited to regional application (i.e., wider area). The City of London is considering similar program. Programming also done in BASIC which has wide application in planning.

3. The usefulness of RISC program will be undermined in future because less and infrequent assessment data will be made available.

4. EXTRACTO is now being replaced by SAS. Problem with EXTRACTO is that it requires a fixed file length. It is mainly used for extracting labels, reports and secondary files. In-house programming is fairly intensive. Customer information and Control System (CICS) is all in-house work. One of the major systems being implemented under CICS is the City of Toronto's Central Property Register. The Register when completed would contain about 10 different data files including current Land Use File and Proposed Development File. These two files store information on present, past and proposed land use for every property in the City. These two files are managed under a separate system called LUPDIS (Land Use and Proposed Development Information Analyzer II (PANZZ) and Direct Access Storage Dump Restore (DASDR). Further details on these programs were not available.

5. The City hopes to get a fiscal impact package in 1982. The City has used SPSS in the past. The present retail package is quite simple nd does not quite meet the City's needs.

6. There are two staff members who can do programming. APL is used by other City departments.

7. No programming done in the planning department. The department has planners who have programming knowledge.

8. No programming done in the planning department.

9. The regional municipality has developed a number of in-house programs to carry out various planning operations. These programs include i) MLS Sales Statistical Model; ii) A program to operate land use inventory system, and iii) Programs to run Property Querry System similar to one developed by the City of Toronto. (This program is not yet operational.)

10. No programming done in the planning department. Data Centre provides programming skills to enable planning department to access information from building and assessment files.

11. Programs are developed by Finance Department to analyse Regional Assessment data every year and also Statistics Canada data.

12. No programming is done in the planning department. City has developed programs which have been used to retrieve information. The planning department has used a package at the University of Waterloo to calculate storm water run-off.

13. The planning department has software packages to operate on Radio Shack TRS 80 (II) micro-computer.

14. No programming done in the planning department. In-house programming is used to produce labels, lists and analysis of survey information. Hired a consultant to write population forecasting model which is run on the University of Waterloo's computer. Programming is also done to prepare lot inventory report and analysis of land supply. The department has also used SPSS in the past.

3.3 Applications

Table 3 is a summary of the planning applications in which a computer is used in the surveyed municipalities. The application areas are divided into three broad groups:

- Data Banking and Control:
- Plan Preparation, Policy Formulation; Plan Review and Monitoring; and
- Development Control

In Table 3, the description of a computer use under a given application is only an indication of where it is mainly being used. No information was collected on the frequency, intensity or complexity of the use of any single operation in a municipality. For example, it may be indicated that a municipality is using a computer for establishing a data bank but no details are given as to the nature, organization, size, complexity of the data bank or whether the data is digitized and, if so, what system of geocoding was used. Detailed information of this kind was beyond the purpose of this overview survey.

It is obvious that more than one planning application may be assisted by the same computer operation. For example, zoning or subdivision applications may be processed by computer and the resulting information used to update property or other files in the data bank, which in turn can be used for any other planning operation, such as plan review or monitoring.

The following table shows the major use of the 31 programs and packages in the three application categories identified above.

The Use of Programs and Packages in Ontario

	Major Applications		
Name of the Program or Package[1]	Data Banking and Control	Plan Preparation, Policy Formulation, Plan Review and Monitoring[2]	Development Control
TPS		X	
UTPS		X	
CORDON COUNT		X	
TR 1907	X	X	
PLAN CODE 1	X	X	
RISC	X	X	
SPSS	X	X	
SAS	X	X	
RTPS	X	X	
SCOPE		X	
UIS	X		
CENTRAL AREA DATA BANK	X		
EXTRACTO	X		
RETAIL SIMULATION		X	
APLDI	X		
VISICALC	X		
DESKTOP PLAN	X		
POP. EMP. MODEL		X	
ASS. INVENTORY	X		
IBM MOD.		X	
DEV. CONT. PROGRAM		X	X
RETAIL PROGRAM		X	
DEMOGRAPHIC MODEL	X	X	
MARK IV		X	
POP. PROJECTIONS	X	X	
MANOR LEVELOB		X	
POP. MODEL		X	
TRANSPORTATION MODEL		X	
STP		X	
SYSTEMS 33		X	
RETAIL IMPACT MODEL		X	

1. For detailed information on packages please refer to Table 2.
2. Monitoring activity is on a very modest scale. On a formal basis (e.g. as described in the Ministry of Municipal Affairs and Housing's **Monitoring Guidelines** — An Approach to Monitoring Official Plans in Ontario 1982) it is not carried out in any of the surveyed municipalities.

The following are some observations from the survey on the use of computers in planning applications:

a. At present, the most common application seems to be the creation of data files from assessment information. All municipalities interviewed do this.

b. The nature and complexity of data files varies widely. In some municipalities, information from census, in-house operations and surveys is also kept and updated on data files, while in others data files are comprised of information only from assessment records.

c. The City of Toronto, Metro Toronto, the City of Ottawa and the Regional Municipalities of Durham, Ottawa-Carlton, Sudbury, Halton and Waterloo operate relatively comprehensive data base systems, of which the City of Toronto has the most elaborate system in the form of a central property registry and the Land use and Proposed Development Information System (LUPDIS).

d. There is a somewhat limited use of computers in the plan making and policy formulation process. In most cases, the use has been limited to some computer analysis or modelling exercises in background studies during plan preparation.

e. The use of computers in a batch mode and on a project basis seems most common. Virtually all municipalities, with the exception of the Town of Stoney Creek, have utilized computers in specific studies.

f. On-line use i.e. direct access and manipulation of computer information, especially for operational or development control purposes, is rare. However, in many municipalities, the development control process is assisted by computers (e.g. record keeping or generation of address labels). The most active use (where processing of a zoning or subdivision application is done on-line) is limited to the Cities of Toronto, Ottawa, North York, London and the Regional Municipality of Ottawa-Carlton.

g. The use of computers is least evident in the plan review or monitoring process, primarily because this activity is also very rare.

h. Computer assisted mapping and graphics is also very rare at the present. Only Metro and the City of Toronto have (batch mode) mapping facilities. The Regional Municipality of Halton has limited graphic (charts and graphs) capability using the MTC computer. The Regional Municipality of Sudbury is working on acquiring thematic mapping capabilities in the near future.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring *	Development Control	
1. Metropolitan Toronto	At present Metro has data files containing information from assessment, employment and land use surveys and transportation data. In future, census and information from other sources will be put on data base files. Sources of data include assessment surveys, census, Statistics Canada and Revenue Canada. About 80% of the information used by the Planning Department is on data files. Building permit and income statistics are not on data files at the present time.	Computer is being used in modelling and evaluation exercices especially in the housing area. Word processing is extensively used. The department has also limited mapping and graphics capability through MIS Department's central mapping facilities.	none	none
2. Regional Municipality of Peel	At present data files contain assessment and employment information. In future the region expects to have wide ranging data (e.g. demographic, land use, employment, housing etc.) on zonal district basis. Present sources of data primarily are assessment records, census and field surveys. Major problems in data are: rounding in census, missing codes and data in assessment and sheer volume of it. Information on data files is about 50% of data used at present. This ratio is expected to improve substantially in the future. Transportation data files are located at MTC.	Word processing is in place. However, computer is not being used in any other aspects of policy plan preparation and review in any significant manner. Nevertheless, transportation models are used extensively to develop the transportation component of plans.	none	none

★ Monitoring activity is on a very modest scale. On a formal basis (e.g. as described in the Ministry of Municipal Affairs and Housing's **Monitoring Guidelines—An Approach to Monitoring Official Plans in Ontario, 1982**). It is not carried out in any of the surveyed municipalities.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications: Data Banking and Control	Major Applications: Plan Preparations, Policy Formulation, Plan Review and Monitoring	Major Applications: Development Control	Comments
3. City of Ottawa	At present data files contain information on population, income, housing, employment, expenditure and retail inventory and land use by individual property. In future, the department expects to have historical property data, sales data, grants information (by property), status of building (e.g. heritage), and data of construction, on data files. Source of data include building files, assessment records, Ministry of Treasury and Economics, Statistics Canada, registry office field survey and private companies such as Data Line. Inaccurate or missing information are major problems (e.g. assessment records show data of construction for only 1% of the properties). Although about 50% of information used is on data files at present, it is expected to grow to about 80%.	The department uses word processing but has a number of problems with it. The computer has assisted in the formulation of policies, evaluation of objectives and assumptions and in the evaluation of alternative plans and strategies. The use of computer in monitoring and review of official plans has been very limited.	Computer is being used in: • preparing summaries of applications and their status (e.g. zoning applications) at any given time • creation of a property file • provision of data in the preparation of amendments and up-keep of zoning by-laws	Computers are not being used fully in the development control process. Improvement is needed.
4. Regional Municipality of Haldimand-Norfolk	At present, assessment, zoning, severrance, building and occupancy information is kept on data files. In future, housing survey and migration information will be added to files. The sources of data include: assessment records, property transfer sheets, severance applications, Statistics Canada, Registry Office and in-house data. Major problems with data are: assessment information is inadequate (would like migration and birth and death figures), and there is tremendous discrepancy between Statistics Canada and assessment information. Hope to transfer all in-house information onto data files in the future.	Computer has been used in a limited way (e.g. employment modelling) in the formulation and evaluation of policies and objectives. Hope to use computer much more effectively in this area in future.	Computer is not being used in development control process at the present time. In future, it is expected that various aspects of development control will be assisted by the use of computer.	Planning Department expects to be able to monitor official plan with computer assisting in data acquisition, storage and analysis.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring	Development Control	
5. City of Toronto	Central property register has 9 files containing a wide range of information on each property in the city. Data files also contain information on census, employment, traffic counts and all in-house data. In future, the department would like to have more information on income, employment, energy consumption, and other socio-economic data (e.g. handicaped persons). Also, it is expected that more regional information will be stored. The sources of data include census, in-house surveys, other departments, other levels of government, and private companies (e.g. LePage). Data from other departments is on-line; from other sources it is on tapes and paper. Major problems with data are: compatibility, jurisdiction and boundary problems, inaccuracy, sheer volume, confidentiality and definition problems (e.g. floor area). Also, a large amount of data used (90%) is on data files. Only some subjective data (e.g. renovation) is not on computer files.	Computer is being used in many aspects of plan preparation and review. The computer is being used for word processing, data banking, analysis, modelling, forecasting of data, and evaluation of policies, assumptions and objectives of official plan. At present mapping and graphics by computer is not on-line. Hope to have on-line capability in future. City's Land Use and Proposed Development Information System (LUPDIS) is of major assistance in all phases of plan preparation and review.	Computer is being effectively used in the development control process—processing of zoning applications, their status, instrument numbers for development agreements, and text of zoning by-laws.	none
6. City of London	Data files at present contain zoning and assessment information. There is certain information obtained from Statistics Canada. In future, the department expects to extract more information from regional assessment file and also add fiscal impact and other data. Major problems with information received is that it is incomplete and out of date. Very little information is on data files at present (about 10%).	The department has used computer in a retail impact study. Expect to use it on a continous basis to assess retail developments and alternatives in 1982. The use of computer in plan making and review is very limited. Only used to get some background information on specific projects.	Processing of zoning applications and pertinent information related to property is kept on-line. All other information is stored on data files which can be used in batch mode only.	Have problems with RISC programs. Compatibility problems with the hardware.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications: Data Banking and Control	Major Applications: Plan Preparations, Policy Formulation, Plan Review and Monitoring	Major Applications: Development Control	Comments
7. City of Thunder Bay	At present, data files contain information on retail space, building permit information, legal description and tax status of properties and population by assessment polling districts. In future, the department expects to put all land use information on data files. Sources of data include assessment records, census and internal sources. Only about 20% of information used is on data files; hope to increase this in future.	Computer assistance is used in word processing and formulation and evaluation of policies and objectives. The use of computer at present is mainly on project basis, such as retail study and parking study.	Prime data from subdivision plans is put on data files. Computer is also used in locating name and addresses of property owners within a given area. Computer is partially used in the preparation of zoning by-laws.	Problems in using RISC program—geocoding, language and compatibility with hardware.
8. City of Sault Ste. Marie	At present, data files contain zoning. Geographic location and assessment information. Prime source of data is assessment records. Data is also received from Statistics Canada, census and internal sources. No major problems with data received. Statistics Canada data comes in slow. In future, more information may be put in data bank.	Word processing recently introduced. Computer has been used in evaluating alternative plans and strategies on a project basis (e.g. industrial park location).	The one-line facility handles up to date information on zoning, location use, structure, size and condition of property in a format that allows for both general enquiries and report creation.	Council has approved a major review of the official plan. It is likely that computer will be used in analysing in formation during this process.
9. Regional Municipality of Durham	At present data files contain information from assessment, in-house surveys and transportation projections. In future, commercial, employment, on-line and transportation survey data will be added to data banks. Data sources include assessment, own surveys, Statistics Canada and internal data. Major problems with data are: incomplete and inconsistent. All data is summerized in printed form.	Computer is assisting in word processing and policy formulation. Computer is largely used for analysis and modelling on project basis such as transportation or retail studies.	none	Data banking is meeting most of the needs at present.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring	Development Control	
10.Town of Stoney Creek	At present, data files contain zoning information. In future, committee of adjustment information and socio-economic data is expected to be added to data bank. Major sources of data are assessment and in-house. Major problem with assessment data is its inaccuracy. Very little information (5% approx.) is on data files at present. Expect to have at least 25% in future.	Assessment information has been used in analysing data for secondary plan.	All new building permits are kept on computer files.	none
11.City of North York	Data file comprised of assessment information and stored on a central property file. In future, more data files containing information on building permits, zoning, health and trees etc, will be created. North York's central property file is on-line and accessible on CRT units. Major problems with data are: very little information is on-line on CRT units and a lot of information is missing because assessment file is geared to taxes. Also assessment information does not contain all the information for which report programs have been written. About 50% of data used is on computer files. This ratio will improve in future.	Computer analysis has been used in the establishment of assumptions for the official plan (population forecasting exercise).	City uses CRT on-line facility to generate address labels from central property file.	none

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring	Development Control	
12. Regional Municipality of Ottawa-Carleton	Data files at present comprised of census data, assessment information, employment data, CMHC housing data and subdivision application data. In future, the department expects to geo-code data on files. Also, bi-annual registered land information and information on multiple listing services will be added to data files. Present sources of data are: assessment, census, in-house surveys and development control. Assessment data quality is very poor. At present, virtually all new data is kept on data files.	The department uses word processing facilities. The use of computer is mainly on a project basis whereby specific policies and objectives are evaluated through computer analysis and modelling. The use of computer in monitoring and review is limited to basically statistical analysis.	Information generated by development control process is kept on data files for future use. This system was developed in 1978. The system utilizes the Region's central computer in an on-line environment in the processing of subdivision and condominium applications, monitoring and updating key statistical data.	Application of computer in plan review and monitoring process is marginal. The development contract systems will be expanded to include building permit data and severence activity.
13. Regional Municipality of Sudbury	Computer files at present comprised of information on land use, population, parking, street index, assessment, and building statistics. Major sources of data are: regional assessment, in-house and Real Estate Board. Data received is sometimes incomplete and with errors. At present about 30% of data used is on computer files. In 5 years, it is expected that 80% of data will be on computer files.	The department is working on acquiring theomatic mapping capability in the near future. The use of computer at present is mainly in the area of providing analysis for evaluation, formulation of policies and objectives and a very limited review of the plan.	Zoning by-law indexes are being kept on computer files.	Both word processing and mapping applications will be in place in the near future. Provision has been made in computer data files for geocodes.
14. City of Peterborough	Assessment information and building information is kept on computer files at present. In future, rezoning application information will be added. Assessment information not up to date, and communication problem with The Minitry of Treasury and Economics. About 20% of data used is on computer files. Hope to double it in future.	Very limited use of computer analysis has been made in evaluation of policies and objectives.	Zoning information is kept on computer files. Also, building file is kept up to date.	none

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring	Development Control	
15.City of Windsor	At present data files are comprised of information produced by Regional Assessment Office and Statistics Canada. In future, zoning, land use, socio-economic data building conditions, heritage buildings, and traffic statistics data will be added to data bank. Assessment information on many land use planning aspects is incomplete. At present only about 20% of data used is in data bank.	Very limited use of computer is being made in analysing housing and population information.	none	none
16.City of Kitchener	There are various computer files incorporating information from assessment, utility records, and city's own tax records. In future, information generated from secondary plan studies, zoning and development history will be added. Some problem with assessment information such as mismatch of roll numbers. At present 40% of data used is computerized.	Planning department has its own word processing facility. Certain programs such as SPSS have been used in the process of policy formulation. It is expected that more computer models, (such as retail model) will be used for assistance in decision making. Plan review and monitoring has been limited to analysis of a socio-economic survey by computer.	Use limited to word processing of text and staff reports.	All information in files can be accessed via street address or roll number of the property. Computer files contain information on four central zones only. Information on other zones is on maps or office files.
17.Regional Municipality of Halton	Computer files consist of assessment records, transportation, energy and environment survey results, council resolutions, library catalogue, and development control information. Assessment information has gaps, improper coding and is not compatible with census. About 60% of data used is on computer files.	Word processing facility shared with other departments. Limited graphics facilities are available on an MTC computer (e.g. graphs and charts). Computer analysis was extensively employed in the background studies during official plan preparation. Computer programs are employed on a continuous basis for population estimates. Further applications of computer relate to specific projects from time to time. Computer analysis being used in developing economic strategy. Very limited use of computer in monitoring and review process.	Application limited to extracting and storing information (in data bank) generated through development control process.	Assessment and development control information files are kept and operated at MTC. All other files are on department's micro computer. In future, development control information will be transferred to department's micro computer.

Municipal Interview Questionnaire
Summary of Computer Applications

Table 3 (Cont'd)

Municipality	Major Applications			Comments
	Data Banking and Control	Plan Preparations, Policy Formulation, Plan Review and Monitoring	Development Control	
18. Regional Municipality of Waterloo	Data files comprised of information from assessment records, transportation data, population and land use. In future, department expects to establish a computerized regional information service which will incorporate a wide range of data from public and private agencies. Present sources of information include assessment, census and surveys. Assessment information not very reliable. Census information comes in late.	The department shares a word processing facility. Computer use has been on project basis. Also, it is used regularly for certain operations such as population projections.	Have file of lot inventory.	At present, all data is stored by traffic zones. The department has capability to convert census data to traffic zone basis. In 1974/75, environmental data bank was developed on a 4 acre grid with the help of University of Waterloo. It has not been updated.

3.4 General Information

Table 4 brings together information which is general in nature and not covered in the previous three sections. This information gives an indication of how and in what manner a planning department started using computers and if survey participants could provide tips or suggestions to those who may be contemplating using computers in their planning departments.

Answers to many questions in this section are rather subjective, especially answers to the question "Can you give any tips or general suggestions to people now thinking of using computers in their planning department?". The answers are very interesting!

The following points highlight the survey information obtained.

a. Generally, there has been very little contribution or involvement of planners in the decisions leading to the purchase of the municipal computer which they now use.

b. In most cases, the use of computers started in the carrying out of a specific study such as a retail, housing, parking or transportation study. Gradually, the use of a computer on a permanent basis, such as data banking, and on-line operations were establsihed.

c. Most municipalities indicated that they use a computer effectively in their planning departments. However, the actual level of use in relation to the total planning activity is not very significant.

d. In two municipalities, there was no staff member directly assigned to the running of computer operations. In others, there were one or more individuals who were involved. In the City of Toronto Planning Department, there are seven full-time and one part-time staff who are familiar and involved in using computer facilities.

e. Most municipalities said they are not saving time or money as such but are doing a lot more work by using computers for planning.

f. Four municipalities said that micro computers can be very effective in planning. Most municipalities did not have a view on how effective micro computers might be for planning. Many of them were of the opinion, however, that data banking and analysis for planning requires large amounts of data which can only be handled by a computer with large capabilities.

g. Most municipalities consider the on-line use of a computer most effective for many operational applications, e.g. in subdivision and zoning approval process.

h. Virtually every municipality indicated that every planning department should have staff who is trained to use computers and with an understanding of software.

i. The poor quality of available data ws cited as the single most important problem municipalities have rather than the process of automation.

Municipal Interview Questionnaire — Summary of General Information

Table 4

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
1. Metropolitan Toronto	N/A	N/A	N/A	quite a way to go yet.	In present day complex environment computer is a must.	3 Professionals 1 Technician	doing more but not saving any money.	• a good and cheap way to get started is to put in a micro computer and use it effectively for a variety of planning jobs. Get staff trained to use computers. Planning departments should have their own independent computer for small jobs.
2. Regional Municipality of Peel	• Economic Section of the Planning Department initiated use of computers in planning.	• Extensive surveys of the "state of the art" • extensive research into technical aspects • hired a consultant to do a feasibility study for the purchase of micro computer • an inter-departmental task force studied the requirements.	For the Mini: • multiple users • simplicity • user oriented • comunication capability • text editing • low cost • update and edit capability on screen	• very effectively. • $24,000 spent annualy on data processing in the policy and Research Division • $20,000 spent annually on data processing in the Transportation Policy Division	• yes • RISC has improved our ability to create planning information • expect it will improve substantially in the future when mini comes in	3+ In planning 3+ In Transportation Division	not saving any money but doing much more.	• any computer file which relates to property should have the assessment role number (for cross-reference and manipulation) • confidentiality should be taken into account. • beware of systems people. They don't understand planner's needs easily. "Efficiency" to them may be different than it is to the planner. • look to what is availabie in packages before doing own programming • geographic identifiers (geo-codes) of some kind should be developed to allow aggregation of data (e.g. census track codes) • if you purchase a small system it should be capable of communicating with microframe and a word processor. • hire people who have some basic knowledge of computers.

Municipal Interview Questionnaire — Summary of General Information

Table 4 (Cont'd)

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
3. City of Ottawa	• Research Division looked into software package	N/A	• main criteria was short term cost	• not very effectively yet	• definitely	1 professional 10 tech. staff	• doing more variety of jobs. Saving on staff time.	• have at least one planner who has training with computer • stay away from consultants. Develop things in-house. • think about long term cost when purchasing computer hardware or developing software • be sensitive to the needs of the users and solicit their input before designing any system.
4. Regional Municipality of Haldimand-Norfolk	• Planning Department	• an inpact study was done in liaison with University of Waterloo	• not sure	• some problems • long way to reach effectiveness	• yes	one	• quality of information needed improved. • saving time using RISC.	• should contact other municipalities who are already using computers • should join or use RISC programs if possible
5. City of Toronto	• Planning and Development	• not sure	• not sure	• very effectively	• yes, definitly	7 full time 3 part time	• saving considerable man power	• should research what is going on • look around first • hardware should be shared (with other departments or agencies) • should only use computer if a real need is there. A lot of effective planning can be done without the use of computers.

Municipal Interview Questionnaire — Summary of General Information

Table 4 (Cont'd)

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
6. City of London	• Planning Department	N/A	N/A	• quite effectively. Lot more potential for improvement. Need more staff to make full use.	• no	one person	• saving time and money on providing zoning information. ($30-$40,000 every year)	• try and get a computer for which packgages are available • planners should be trained to make maximum use of computer without assistance from systems people • try not to get something which is too complicated to use. • maintenance and updating costs should be considered • select software carefully. May not suit your specific need • data requirements should be understood
7. City of Thunder Bay	• Planning Department started using computers 3 years ago.	• people using software were contacted (e.g. Lakehead University)	• not sure	• very effective on project basis which is the main use at present.	• yes	3 planners	• doing more but not saving anything	• municipality should define its own objectives • make sure municipality has adequate technical support • depending on the size of the municipality an independent micro or mini computer can be of great help.
8. City of Sault Ste. Marie	• Planning Department	• hired consultants to do research • staff's previous experience also contributed	• for micro computer 1. ability to communicate with Univ. of Waterloo computer 2. Local availability	• effectively	• quality of information has improved	3 planners	• a lot	• no point in buying computer if no one on staff is competent to use it • big lack of software for planners is a problem. This should be considered. • micros will prove to be very effective in planning.

Municipal Interview Questionnaire — Summary of General Information

Table 4 (Cont'd)

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
9. Regional Municipality of Durham	• Planning Department	• Cost benefit analysis was done in-house • in 1974 consultant did a study for the whole region	• cost efficiency	• very effectively	• yes	• 2 planners	• quality of information improved • doing a lot more than before	• small sized municipalities should not get into computerisation • RISC is not suited for application to smaller municipalities (ie 50,000) • assessment inventory programs should be used by smaller municipalities (such as one developed by Durham)
10. Town of Stoney Creek	N/A	N/A	N/A	• not too effective for planning	• quality of service to public has improved	none	• saving time on inquiry • also saving time on circulation	• always do the study to explore available options • planned and phased implementation very important
11. City of North York	• Metro Toronto Planning Department, (for Micom) Division of Long Range Planning and Research	• market search	• price, capability and serviceability	• very effectively	• yes • Micom has improved quality of text	N/A	• substantial	• investigate City of Toronto's LUPDIS systems
12. Regional Municipality of Ottawa-Carlton	N/A	N/A	• needs of the dept. • should be capable of producing mailing list • capacity to grow & update	• municipality's central computer (main frame) not effectively used • micro used more effectively	• to some extent	• 3 planners • 1 technician familiar with its use	• doing a lot more	• first evaluate existing methods, strengths and weaknesses of various approaches. • outline user requirements and desired features • estimate time and money requirements • assess flexibility of procedures • determine projected frequency of use • look into maintenance and operational requirements • should have staff support • get hardware and software from top manufacturers • don't buy planned obsolence

Municipal Interview Questionnaire — Summary of General Information

Table 4 (Cont'd)

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
13. Regional Municipality of Sudbury	• Planning Department	N/A	N/A	• not as effectively as could be. Effectiveness will increase as more applications are added.	• marginally	• 2 technicians	• substantial saving	• for data base set up overall working system before embarking on any single part and evaluate relationships • co-operation between departments essential • hardware equipment is not the answer, should take systems view • should hire planners with systems knowledge • planning packages not available for micros
14. City of Peterborough	N/A	N/A	N /A	• not very effectively	• not sure	• one planner	• significant time saving	• planners should be able to communicate with data people • planners should always liaise and consult with data people before purchasing any independent system (e.g. mico)
15. City of Windsor	N/A	N/A	N/A	• very little	• it has helped to improve information base	• one planner	• considerable	• analyse all the functions of the planning department and also establish the interdepartmental functions before developing any computer based analysis or activities
16. City of Kitchener	• Planning Department	• had previous experience	• more capacity • flexibility	• effectively	• yes	• most staff familar with computers	• a fair amount of time	• hire a student in summer and do assessment • should look into the possibility of using a university computer • should first develop centralised property file • don't start a program unless you can maintain it (e.g. sufficient staff should be available)

Municipal Interview Questionnaire — Summary of General Information

Table 4 (Cont'd)

Municipality	Who Initiated Computer Use?	Research Done	Criteria Used	How Effectively are Computers Used?	Improvement Achieved	Staff Directly Involved	Savings of Time or Money	General Tips and Suggestions
17. Regional Municipality of Halton	• Planning Department	• looked at a number of micro computers	• cost, software support, flexibility (e.g. capacity to increase memory	• micro is effectively used. MTC computer is also effectively used.	• improved access to and quality of information	• one person	• doing a lot more	• planning can never get full use of a municipal computer. Best to have own computer. • large micros can be very effective in planning
18. Regional Municipality of Waterloo	N/A	N/A	N/A	• fairly effective. Can make lot more use.	• yes	• all senior planners involveld part time	• a reasonable saving of time	• it is important to have a plan of future use before purchasing • on-line use effective for planning

4. A Checklist For Using Computers in Planning: Some Basic Questions

The following checklist covers the very basic issues that must be considered when the use of computers is being contemplated by a planning department. The section should also be useful to those who are in the preliminary stages of computer usage in planning.

Objectives:

- Do we need to enhance our capacity to assemble, analyse and synthesize data?
- Do we need to increase the efficiency of service delivery by cutting administrative costs, avoiding data duplication and offering greater management control and accountability?
- In what way is the quality of the planning service expected to be affected by the use of computers? Will it improve significantly or marginally?
- To what extent will the use of computers reflect on the image of the planning department within the corporation and in the public eye? Would it enable it to play a more affirmative role in the overall corporate decision-making structure?

Potential Applications:

- How is information being handled now? At what level should data be held or aggregated?
- What current operations are taking too much staff time where computer assistance will result in considerable saving of time?
- What are the key operations which, if automated, will result in an overall more efficient and responsive planning service?
- What are the areas where the quality or timeliness of service is of prime concern, and should be improved?

Hardware:

- What mainframes, mini and micro computers are available?
- What is the cost of purchasing, leasing, and renting?
- What are the requirements and costs of time sharing with another agency's mainfrme?
- What are the costs of peripherals such as printers, disc drives, etc.
- What are service and maintenance requirements for various types of hardware? Are there any special requirements or constraints?
- What type of hardware is being used by other departments, by other municipalities, the province and the private sector?
- What other hardware is compatible and can be integrated with our chosen hardware?

Software:

- What commercial packages are available? Are they suitable in terms of costs, support and application?
- What packages or programs have been produced by other municipalities, the province, and the universities? Are they suitable to our needs? Can they be obtained?
- Is available software compatible with our available hardware?
- What progress or problems are being experienced by users of available software?
- What are our existing and potential resources to produce our own programs?
- What is the cost and other aspects of acquiring custom made software?

Management, Financial and Personnel Questions:

- What degree of support is available from management and other departments if computer use is introduced?
- At what level of sophistication, initialy, do we need to use computers?
- Should we go for an integrated system or a stand alone system ? (The choice would depend upon the "way" the present organization is set up).
- To what degree would existing municipal computer facilities meet the needs of the planning department?
- What financial resources do we have which can be allocated to automation?
- How should we ensure everyone's participation in the development of a computer system—who will be affected by it?
- Do we have someone on staff who is a good comunicator and technically competent to help in the early stages of implementation?
- What are the computer training requirements for all levels of staff?

Appendix: Selected Annotated Bibliography

1. AUERBACH Publishers Inc.
   Computers in Local Government—Urban and Regional Planning. 1980.

   This publication is designed to help local governments make better use of computer technology. It was conceived and developed to respond to the demonstrated need in local governments for advice on wide range of computing issues. The goal of this publication is to provide timely, relevant and accurate information that translates into direct pay offs for local government. The publication also includes many useful articles planning, case studies, a software directory and hardware selection and evaluation.

2. Ministry of Municipal Affairs and Housing.
   Using Computers—A Guide for Municipalities in Ontario. March, 1980.

   This publication is meant to help managers in local government organizations answer key questions regarding selection of hardware and software most suited to their organization. Questions such as: What are the impacts of acquiring certain equipment and services? What can users of computers expect, and what is expected of them? What factors should be considered and compared when choosing courses of action in a local government environment? are specifically addressed in this publication.

3. Ministry of Municipal Affairs and Housing
   1981 Directory of COMPUTERS AND APPLICATIONS in Ontario Municipalities. December, 1981.

   The Directory provides a ready reference on municipal hardware, software, applications and operations. It contains an alphabetical index of every municipality in Ontario, a cross-reference of computer applications and data processing facilities in each municipality.

4. Schmitt, Rolf R
   More For Less: Information Systems, An Era of Limits.
   Papers from the Annual Conference of the Urban and Regional Information Systems Association
   August 19-23, 1979. San Diego, California.

   These papers deal with the following topics:

   - Designing Information Systems in an Era of Limits.
   - Addressing Federal and State Information Needs.
   - Changing Information Needs and Responses in Transportation.
   - Information for Local Public Service and Utilities.
   - Reducing Costs of Collecting and Displaying Information.

   These papers place a strong emphasis on applications and experiences with operating systems.

5. Centre for Resources Development, University of Guelph.
   Methodology Study and Development of a Data Base for Rural Land Evaluation in Ontario. December, 1978.

   In 1978 the Land Resource Research Institute, Agriculture Canada initiated a program to evaluate rural land. The main objectives of this study were to develop a first order multiple land use allocation model based on the entropy approach, to evaluate this using available data and to refine it where necessary.

6. Ministry of Natural Resources. *Proceeding of Seminar on Geographical Referencing.* Sponsored by Interministerial Committee on Geographical Referencing, March 1981.

   The Interministerial Committee on Geographical Referencing (ICOGR) was formed to provide a forum for the discussion and exchange of information on geographical referencing activities in Ontario. The Committee is studying referencing needs and developing and promoting the adoption and use of standards towards the implementation of a comprehensive geographical referencing system. ICOGR is attempting to develop standards which in time may be incorporated into many of the information systems in the Province in order to facilitate the transfer and correlation of geographically referenced data.

7. Institute of Urban and Regional Research, University of Iowa.
   URISA Professional Paper Series. Geo-Processing in Local Governments: A Feasibility Study for the City of Omaha, 1977.

   This report represents the culmination of a year and a half of private research conducted by the author in an attempt to assess the current state of the art in goe-processing technology for use in local government. The report extensively review the development and use of DIME (Dual Independent Map Encoding) geographic base file system.

8. Department of Community Development City of Ottawa.
   Urban Information Study: Feasibility Study February, 1974.

   This study was undertaken to determine the feasibility of developing an Urban Information System which would meet the

data requirements and information needs of the Planning Branch in the Department of Community Development. The study also provides recommendations for the major components (hardware and software) of the conceptualized system, an implementation plan and an analysis of costs and benefits associated with the system's development.

9. *Computer Assisted Information Systems and Computer Assisted Cartography: Tools and Tinker Toys of Urban Governance.*

   Paper presented at the Second International symposium on Computer Assisted Cartography—Auto Carto III, Reston, Virginia, U.S.A., September 21-25, 1975.

   This paper is a commentary on the role of computer assisted information systems and computer assisted cartography in the field of urban governance. It examines the relationship in terms of the purposes, ways and extent of use. Of particular importance in the commentary is the matter of how the technologies have evolved vis-a-vis changes over time on the part of persons and activities associated with urban governance.

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